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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/777,026	02/11/2004	Mark N. Kawaguchi	8033/ETCH	2197
55649 7590 02/13/2007 MOSER IP LAW GROUP / APPLIED MATERIALS, INC. 1040 BROAD STREET 2ND FLOOR SHREWSBURY, NJ 07702			EXAMINER TRAN, BINH X	
			ART UNIT 1765	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE			MAIL DATE	
3 MONTHS			02/13/2007	
			DELIVERY MODE	
			PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/777,026

Applicant(s)

KAWAGUCHI ET AL.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-23, 25-31 and 35-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 11-12, 17-19, 21-23, 25-30, 35-42 is/are rejected.
- 7) ☒ Claim(s) 9, 13-16, 20 and 31 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01-31-2007 has been entered.

Claim Objections

2. In claims 35, 39 the examiner suggests replacing the phrase "further comprising" to --wherein--. The applicants already recite the step of "heating the substrate in a gas mixture of oxygen and nitrogen" in claims 1 and 21. The term "further comprising" implies additional step. The term "wherein" refers to the previous cited step.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 12, 17, 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 depends on claim 6. Oxygen and nitrogen gas are used in both heating step and plasma exposing step. Therefore, it is unclear from the claim whether the flow

rate ratio of oxygen to nitrogen is referred to the ratio during the heating step, or the ratio during the plasma exposing step or the ratio during both steps.

Claim 17 depends on claim 6 which depends on claim 1. Applicants disclose to use oxygen gas in the heating step (claim 1) and in the plasma exposing step (claim 6). Therefore, it is unclear from the claim the oxygen pressure in claim 17 is referred to the pressure during heating step, or the pressure during in the plasma exposing step, or the pressure during both steps.

Claim 19 depends on claim 9. In claim 9, applicants disclose there are two possible hydrogen-containing gases: hydrogen (H_2) and water vapor (H_2O). Therefore, it is unclear that "the hydrogen-containing gas" pressure in claim 19 is referred to the pressure of hydrogen gas (H_2), or the pressure of water vapor (H_2O), or the pressure of both H_2 and H_2O vapor.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

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not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-8, 11-12, 17-18, 21-23, 26-30, 35-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 5,545,289) in view of Belyansky et al. (US 6,562,713).

Respect to claims 1-2, 21-22 Chen discloses a method for removing halogen-containing residue from a substrate, (col. 5 lines 1-6), the method comprising the steps of:

providing an etched substrate having a halogen-containing residues, comprising at least chlorine (col. 5 lines 1-6; col. 6 lines 40-50)

heating the etched substrate to the temperature about 250 °C in a gas mixture comprising oxygen and nitrogen (read on applicant's range of "at least 50 °C" and/or "50 °C to about 450 °C" for claim 2; Col. 17 lines 45-47, col. 18 lines 15-19; Table VIII, example 51-52, stripping step);

exposing the heated substrate to a plasma that removes the halogen-containing residues, col. 6 lines 40-50; col. 18 lines 9-13, Table VIII, example 51-52, passivating step).

Chen fails to disclose the halogen-containing residue is formed during etching of a polysilicon layer on the substrate. However, Chen clearly discloses the halogen-containing residue (24) is formed during the etching step of layers on the substrate. Chen further discloses layer (28c) comprises silicon material (col. 4 lines 62-65). In a

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semiconductor process, Belyansky teaches to etch polysilicon layer to form a polysilicon gate using halogen gas (col. 3). Belyansky further discloses to the halogen-containing residue (bromine residue) remains after the etching of polysilicon layer can be easily removed using oxygen plasma (col. 4 lines 1-12). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chen in view of Belyansky by etching a polysilicon layer using halogen-containing gas including bromine because the bromine residue can be easily removed after the etching step. Further, polysilicon layer is needed to form a polysilicon gate.

Respect to claims 3 and 23, Chen discloses forming the plasma by energizing a gas mixture in a remote plasma reactor (54) (See Fig 2). Respect to claims 4 and 26, Belyansky discloses the halogen-containing residue comprises bromine (col. 4 lines 3-12). Respect to claims 5 and 27, both Chen and Belyansky discloses the plasma comprises an oxygen-containing gas (Chen's col. 18 lines 9-13; Belyansky's col. 4 lines 10-12). Respect to claims 6 and 28, Chen teaches to use oxygen plasma and an additive comprises N₂ (col. 18 lines 9-13, col. 6 lines 65-67).

Respect to claims 7 and 29, Chen discloses the halogen-containing residue comprises chlorine (col. 5 lines 1-5). Respect to claims 8 and 30, Chen discloses the plasma comprises water vapor (i.e. hydrogen-containing gas; See col. 18 lines 9-13). Respect to claim 11, Chen discloses the temperature of about 250 °C (Table VIII). Respect to claim 12, Chen teaches the flow rate ratio of oxygen to nitrogen equals to 10:1 (col. 8 lines 19-20).

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Respect to claims 17-18, Chen discloses the pressure of preferably about 2 Torr (col. 18 lines 10-13) and the duration for the exposing step is about 1-60 seconds, (col. 26 lines 60-61, col. 23 lines 27-29).

Respect to claim 22, Chen discloses the temperature is between 250-300 °C (Table VIII, read on applicant's range of 150-400 °C).

Respect to claims 35 and 39, Chen discloses heating the substrate for a period of 20 seconds (Table VIII, example 52, stripping step).

Claims 36 and 40 differ from Chen by the specific flow rate of oxygen and nitrogen gas. However, Chen clearly teaches the flow rate of oxygen and nitrogen is a result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal flow rate for oxygen and nitrogen as an expected result.

Respect to claims 37, 41, Chen discloses the oxygen and nitrogen flow ratio of about 6:1 to about 200:1, preferably from about 10:1 to about 12:1. Respect to claims 38 and 42, Chen discloses the substrate is heating to a pressure about 1-100 torr, more preferable 1-10 torr, and most preferable 2 torr (col. 18 line 15-17, col. 7 lines 62-64)

8. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen and Belyansky et al. as applied to claim 21 above, and further in view of Wu (US 6,133,102).

Respect to claim 25, Chen fails to disclose the etching the substrate having a film stack with a gas mixture comprising a halogen gas and a reducing gas. However, Chen and teaches to etch using halogen gas (BCl_3 and Cl_2). Belyansky clearly teaches to etch to etch polysilicon layer using halogen including Cl_2 , Br_2 , F_2 (See col. 3 lines 49-65) or HBr/O_2 (col. 4 lines 5-10). Wu teaches to polysilicon layer (120) by using halogen-containing gas (CF_4) in addition with hydrogen gas (read on reducing gas) or HBr/O_2 (col. 3 lines 41-51). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chen and Belyansky in view of Wu by using halogen gas and reducing gas (i.e. H_2) because equivalent and substitution of one for the other would produce an expected result.

Allowable Subject Matter

9. Claims 9, 13-16, 20, 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claim 19 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest the step of exposing the heated substrate to a plasma comprises hydrogen, water vapor, oxygen and nitrogen to remove the halogen containing residues in combination with all other limitation in the claims.

Response to Arguments

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12. The applicant argues that Chen fails to teach the step of “providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate, as recited in claim 1, or providing a substrate having a polysilicon layer on the substrate and etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate, as recited in claim 21”. This argument is not persuasive because the examiner never stated that Chen discloses the above steps. The examiner clearly recognizes that Chen fails to teach the above step as stated by applicants. However, Belyansky clearly teaches to etch polysilicon layer to form a polysilicon gate using halogen gas (col. 3). Belyansky further discloses to the halogen-containing residue (bromine residue) remains after the etching of polysilicon layer can be easily removed using oxygen plasma (col. 4 lines 1-12). Thus, the examiner still maintains the previous ground of rejection under Chen in view of Belyansky.

The applicants further argue, that “the cited portion [Table 1] of Chen shows a gas composition of oxygen and nitrogen from which a plasma is formed for a stripping step during which, in the same process step, the substrate is heated. Accordingly, Chen fails to teach or suggest first heating the etched substrate to a temperature of at least 50°C in a gas mixture comprising oxygen and nitrogen, and subsequently exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claims 1 and 21”. This argument is not persuasive. In col. 18, 6 and Table VIII, Chen discloses the substrate is heated under oxygen and nitrogen gas to a temperature 250 °C (Table VIII, col. 18 lines 15-18, stripping step), then the heated substrate is exposed

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to the plasma (passivation step) in order to remove halogen containing residue (Table VIII, col. 18 lines 9-14, col. 6 lines 40-50).

The applicant's argument with respect to dependent claims 9 and 31 is persuasive. Thus, the examiner withdraws the previous ground of rejection.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Binh Tran

Binh X. Tran